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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/707,465
Filing Date: December 16, 2003
Appellant(s): ROSENZWEIG ET AL.

MAILED
MAY 31 2007
GROUP 1700

Domenica N.S. Hartman
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 1/18/07 appealing from the Office action mailed 4/18/06.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

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The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct. The arguments by appellant on Page

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,475,289	SCHILBE ET AL.	11-2002
6,265,022	FERNIHOUGH ET AL.	7-2001
5,707,453	SHURMAN ET AL.	1-1998
2005/0035086	CHEN ET AL.	2-2005

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-10 and 14-20 is rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (APA) in view of U.S. Patent 6,475,289 to Schilbe et al, or alternatively, in view of U.S. Patent 6,265,022 to Fernihough et al.

Regarding Claims 1, 5-7, 15-16, and 18, the admitted prior art (APA) recites a process comprising the steps of: forming an aluminized surface within an internal cavity of a gas turbine engine component by injecting a slurry into the internal cavity and then heating the slurry and the component, the slurry comprising metallic particles of an aluminum source, oxide particles, and an activator that are mixed and suspended in a liquid vehicle, the activator vaporizing during heating to react with the metallic particles and form a volatile aluminum halide, wherein some of the metallic particles oxidize to form oxidized particles that sinter to the aluminized surface. The admitted prior art teaches that it is known to then remove the oxidized particles by mechanical cleaning such as high-pressure water jets, or by employing caustic compounds at high temperatures and pressures (e.g. performed in an autoclave)

The admitted prior art (APA) does not teach contacting the aluminized surface with an aqueous caustic hydroxide solution until the adherent particles are removed from the surface.

However, Schilbe et al. teach that a suitable caustic compound for removal of oxidized particles from the internal cavities of turbine components is an aqueous hydroxide solution (balance water) such as potassium hydroxide (KOH). (See Col. 2, Line 37 - Col. 3, Line 44) Note that de-ionized water is an obvious expedient for the water in forming the solution as recognized by one skilled in the chemical arts.

It would have been obvious to one of ordinary skill in the art at the time of invention to use the caustics (KOH) well known in the art for removal of strongly adherent oxides from the internal surfaces of turbine components without damaging superalloy materials.

Alternatively, Fernihough et al. teaches that (KOH) is suitable caustic compound for removal of ceramic or metallic particles from internal surfaces of a turbine component after an aluminizing process. (Col. 5, Line 35 - Col. 6, Line 30)

In view of the teachings of Fernihough et al, it would have been obvious to one of ordinary skill in the art at the time of invention to use (KOH) after an aluminizing process in order to suitably remove strongly adhering residual metal oxides (ceramic) from the internal surfaces of turbine components. Note

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that application of potassium hydroxide as recited in Fernihough et al. in the form of a solution would have presented itself as an obvious expedient to one skilled in the cleaning art, and thus does not require inventive or creative effort.

Regarding Claims 2-4, 8-10, 15, 17 and 19, the cited dependent claims differ from applicant's admitted prior art (APA) in view of U.S. Patent 6,475,289 to Schilbe et al. only by specifying various concentrations temperatures and process conditions. However, as one of ordinary skill in the chemical arts recognizes, such process conditions may vary depending on the amount of adherent metal oxides to be removed from the component. A person having ordinary skill in the art at the time of the claimed invention would have found it obvious to modify the prior art by using different processing parameters because same were known to be cause effective variables and routine experimentation would have been expected to optimize them for the particular amount of metal oxides to be removed. *In re Boesch*, 205 USPQ 215 (CCPA 1980).

Generally, changes in temperature, concentrations or other process conditions of an old process do not impart patentability unless the recited changes are critical, i.e., they produce a new and unexpected result.

Regarding Claims 14 and 20, the APA, Fernihough et al. and Schilbe et al. are directed at cleaning cooling passages in a turbine blade and the like.

Claims 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (APA) in view of U.S. Patent 6,475,289 to Schilbe et al. or alternatively, in view of U.S. Patent 6,265,022 to Fernihough et al. and in further view of U.S. Patent 5,707,453 to Sherman et al.

Regarding Claims 11-13, the (APA) in view of Schilbe et al. does not teach using ultrasonic agitation. However, it is old in the turbine component cleaning art to use ultrasonic energy to remove adherent oxide particles and the like from internal passages. For example, Sherman et al. teaches using 20 kHz with a mild alkali solution. (Col. 4, Lines 38-43)

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It would have been obvious to one of ordinary skill in the art at the time of invention to use ultrasonic agitation to increase removal efficiency from the internal passages of turbine components as taught by Sherman et al.

Claims 1-11 and 13-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (APA) in view of U.S. Patent Application Publication 2005/0035086 to Chen et al.

Regarding Claims 1, 5-7, 14, 18 and 20, the admitted prior art (APA) recites a process comprising the steps of: forming an aluminized surface within an internal cavity of a gas turbine engine component by injecting a slurry into the internal cavity and then heating the slurry and the component, the slurry comprising metallic particles of an aluminum source, oxide particles, and an activator that are mixed and suspended in a liquid vehicle, the activator vaporizing during heating to react with the metallic particles and form a volatile aluminum halide, wherein some of the metallic particles oxidize to form oxidized particles that sinter to the aluminized surface. The admitted prior art teaches that it is known to then remove the oxidized particles by mechanical cleaning such as high-pressure water jets, or by employing caustic compounds at high temperatures and pressures (e.g. performed in an autoclave)

The admitted prior art (APA) does not teach contacting the aluminized surface with an aqueous caustic hydroxide solution until the adherent particles are removed from the surface.

However, Chen et al. teaches using a KOH solution for removal of corrosion oxides from a turbine engine component having a temperature of 60-100°C a concentration of 10-50% and a cleaning time of 20 min to 4 hours, (Paragraphs 37-38) and using ultrasonic agitation. (Paragraphs 39 and 34) Note that the step of rinsing with water is notoriously old and well known in the cleaning art for removing caustics and the like from the surface.

It would have been obvious to one of ordinary skill in the art at the time of invention to use the caustic solution of Chen et al. since Chen et al. teaches that the solution is well suited for removal of the

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strongly adherent alumina scale and other metal oxides that form on the internal surfaces of turbine components without damaging underlying coatings (Paragraphs 2 and 23).

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (APA) in view of U.S. Patent Application Publication 2005/0035086 to Chen et al. and in further view of U.S. Patent 5,707,453 to Sherman et al.

Regarding Claims 12, Chen et al. teach using ultrasonic agitation but does not expressly teach power or frequency. However, Sherman et al. teaches up to 400 watts/in² using 20 kHz with a mild alkali solution. (Col. 4, Lines 38-43)

It would have been obvious to one of ordinary skill in the art at the time of invention to use ultrasonic agitation using the ranges of Sherman et al. to increase the efficiency of the cleaning solution in the well-known manner.

(10) Response to Argument

Regarding Schliber et al, appellant argues (Rule 132 Declaration section 8(a))

"Oxide particles from engine dirt and debris typically comprise components based upon aluminosilicates modified with iron, magnesium, calcium, potassium, and other potential impurities. While pure alumina may be present in the dirt deposits, many other chemicals are also present. The microstructure of these dirt deposits may range from polycrystalline to amorphous or even glassy. The interface with the base metal is typically well defined with only limited interaction with the deposit, since the operating environment on the internal cavities is less than about 1600°F."

Similarly, Regarding Chen et al, appellant argues (Rule 132 Declaration section 8(b)),

"Hot corrosion products are formed by definition in the presence of corrodants, typically a sodium and sulfur containing compound. The nature of hot corrosion is to break down and flux the protective alumina scale that forms on bare or coated nickel-based superalloys. The scale formed typically is mixture of alumina plus nickel and chromium oxides. The scale may contain impurities contributed by the corrodant, (primarily Na and S), from the base metal (Ti, Ta, W, Mo, etc.), and from the ever-present engine dirt (Ca, Fe, Mg, K, etc.). The microstructure of hot corrosion products is typically voluminous, layered, porous, and non-adherent, which contribute to the rapid degradation from hot corrosion. While the corrosion products are formed by chemical reaction with the base metal or coating, the interface temperatures typically are less than 1700°F at the corrosion front."

However, the declaration provides no reasoning or support for the counterintuitive conclusion that the lack of additional impurities in the (APA) would be expected to somehow hinder the alumina removal

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by a strong caustic such as KOH, which is specifically taught in the turbine cleaning art to be particularly well suited for removal of strongly adherent metal oxides, such as alumina, without damaging underlying aluminide coatings. It is further noted that Appellant's specification (Paragraph 5) teaches that the aluminizing process of the claimed invention may also contain additional impurities. *"The method also serves to remove other particles that may be sintered to the aluminized surface following the aluminizing process, such as oxide particles that were mixed with the aluminum source powder as an inert dispersant."* The appellant states that *"the microstructure of hot corrosion products is typically voluminous, layered, porous, and non-adherent"*. However, the statement is unclear since it is well known in the chemical arts that oxides such as the metal oxide scale that forms on turbines is very strongly adherent to the sidewalls and passages and can only be removed by strong chemicals, abrasive blasting and the like. (See background sections of Schlide Shurman and Chen).

Regarding Fernihough et al, Appellant argues (Rule 132 Declaration section 8(c)) that

"Fernihough seems to emphasize ceramic plugs that contain mixtures of ceramic components and possibly also organic binders. It is important to note that the plug material is a foreign material introduced to the component. It would be expected to have a definite physical and chemical interface between the component base metal and the ceramic plug. Also the intended temporary nature of the ceramic plug would lead toward the tendency for it to be porous and contain only a green strength and not be fully hard and densified.... So in summary, the plug material of Fernihough can be inferred to be porous, not well bonded to the substrate, formed at low temperatures, and possibly containing many constituents other than pure alumina."

However, the argument is not persuasive because Fernihough teaches heating the plug material "with essentially no polymerizing agent" performing an aluminizing process and removing only the "residual ceramic" with KOH. Thus, appellant's discussion of the interface and density of the plug prior to sintering is not relevant to the residual ceramic particles that are removed in Fernihough.

Appellant argues (Rule 132 Declaration section (7) that

"We and our co-inventors conceived the claimed process after encountering difficulties with removing oxidized coating particles that had sintered to internal wall surfaces following aluminization of the walls. Because the particles form and adhere in-situ through a combined process of oxidation of the particles, sintering of the particles, and aluminization of the walls, the particles are firmly attached to the aluminized walls through a combination of fusion with the wall surfaces as a result of the oxidation and sintering processes and bonding with aluminum from the aluminizing process."

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However the argument is not persuasive to overcome the rejection since the particles of Schilbe Chen and Fernihough are also firmly attached through a combined process of oxidation of the particles, sintering of the particles at high temperature and bonding with an aluminide surface.

Appellant argues (Rule 132 Declaration section 8(d)) that

"While caustic solutions have been known to clean and remove oxides from turbine components, it was not obvious that caustic solutions would successfully remove the distinctly different, well-bonded, and chemically pure, aluminum oxides formed in-situ by an aluminizing process."

However, the argument is not persuasive to overcome the rejection since one of ordinary skill in the chemical arts would expect the oxides, which are formed of the same material (aluminum and other metal impurities) and bonded to the same material (aluminide surface of a superalloy turbine component) at high temperatures and under similar process conditions to be removed by KOH with a reasonable expectation of success.

Appellant concludes that

"the oxides removed by Schilbe and Fernihough are not formed in situ during an aluminizing process of the same surface to which the particles are concurrently sintered. As a result, Schilbe's and Fernihough's oxides are not firmly attached to the aluminized walls through a combination of fusion with the wall surfaces as a result of the oxidation and sintering processes and bonding with aluminum from the aluminizing process." Appellant further argues *"Because their processes do not involve aluminizing a surface, Appellants believe that Schilbe and Fernihough do not provide a reasonable expectation of success for using of a caustic hydroxide solution to remove oxide particles that are not just sintered to a surface, but are metallic particles that are oxidized, sintered, and aluminized to a surface."*

Regarding Chen applicant similarly argues,

As a result, Chen's oxides are not firmly attached to the aluminized walls through a combination of fusion with the wall surfaces as a result of the oxidation and sintering processes and bonding with aluminum from the aluminizing process...Because their processes do not involve aluminizing a surface, Appellants believe that Chen does not provide a reasonable expectation of success for using of a caustic hydroxide solution to remove oxide particles that are not just sintered to a surface, but are metallic particles that are oxidized, sintered, and aluminized to a surface."

However, the arguments are not persuasive. The oxide particles of the APA are oxidized and sintered at high temperature and are thus bonded to the outside of an aluminized surface of a turbine component. The oxide particles of Schilbe, Chen and Fernihough references are also at high temperature

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and sinter or bond to the outside of an aluminized surface. The fact that the particles themselves may be attached to the aluminide surface near the end of an aluminizing process instead of afterwards would not be expected to affect either the bonding of the particles to the surface or the removal process of the particles by KOH. Note that applicants specification (Paragraph 5) teaches that *"The method is particularly suited for the removal of oxidized particles that form as a result of oxidation of the aluminum source powder used in slurry aluminizing processes, wherein the oxidized powder particles become attached by sintering to the aluminized surface. The method also serves to remove other particles that may be sintered to the aluminized surface following the aluminizing process, such as oxide particles that were mixed with the aluminum source powder as an inert dispersant."*

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,



R. Culbert

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